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FLOOD INSURANCE STUDY

VILLAGE OF CROOKSVILLE, OHIO

PERRY COUNTY

MARCH 4, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 390441

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

VILLAGE OF CROOKSVILLE,
PERRY COUNTY,
OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Crooksville, Perry County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Geological Survey (USGS), Columbus, Ohio (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-84-E-1548, Project Order No. 1. This study was completed in May 1986.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor; Ohio Department of Natural Resources, Division of Water; and the Village of Crooksville, Ohio, in March 1984.

Requests for information pertinent to this study were made to the U.S. Department of Agriculture, Soil Conservation Service; U.S. Army Corps of Engineers (COE), Huntington District; and the Perry County Engineers. The COE provided high-water mark elevations.

Results of the hydrologic analyses were coordinated with the COE, Ohio Department of Natural Resources, U.S. Department of Agriculture, and the Perry County Engineers.

On April 13, 1987, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Crooksville, Perry County, Ohio. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of Moxahala Creek was studied in detail within the community.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. These areas include flooding on Burley Run from the upstream corporate limits to the confluence of Moxahala Creek, flooding on Snake Run from the upstream corporate limits to the confluence of Moxahala Creek, and flooding north of the confluence of Burley Run at Moxahala Creek and west of Conrail.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through May 1991. The scope and methods of study were proposed to and agreed upon by FEMA and the Village of Crooksville.

2.2 Community Description

The Village of Crooksville is located in eastern Perry County in central southeastern Ohio approximately 50 miles east-southeast of Columbus and 13 miles south of Zanesville, Ohio. Crooksville is surrounded by the unincorporated areas of Perry County. The total land area within the corporate limits is approximately 0.25 square mile. The 1980 population was reported to be 2,766, a decrease from the 1970 population of 2,828 (Reference 1).

Crooksville is located in the unglaciated part of the State of Ohio. The village lies in the Moxahala Creek valley, and is flanked by steep hills to the east and west.

The unglaciated terrain is rough and highly dissected by local drainage. Soils generated from weathering of sedimentary rock range from deep, well drained soils in the uplands to poorly drained alluvial soils in the floodplains.

The average annual precipitation of the study area is 39 inches and is fairly uniformly distributed throughout the year (Reference 2).

2.3 Principal Flood Problems

The Village of Crooksville has experienced extensive damage in previous floods. The most significant flooding occurred in June 1950 and March 1963; the former was the greatest flood experienced in the Crooksville area. The

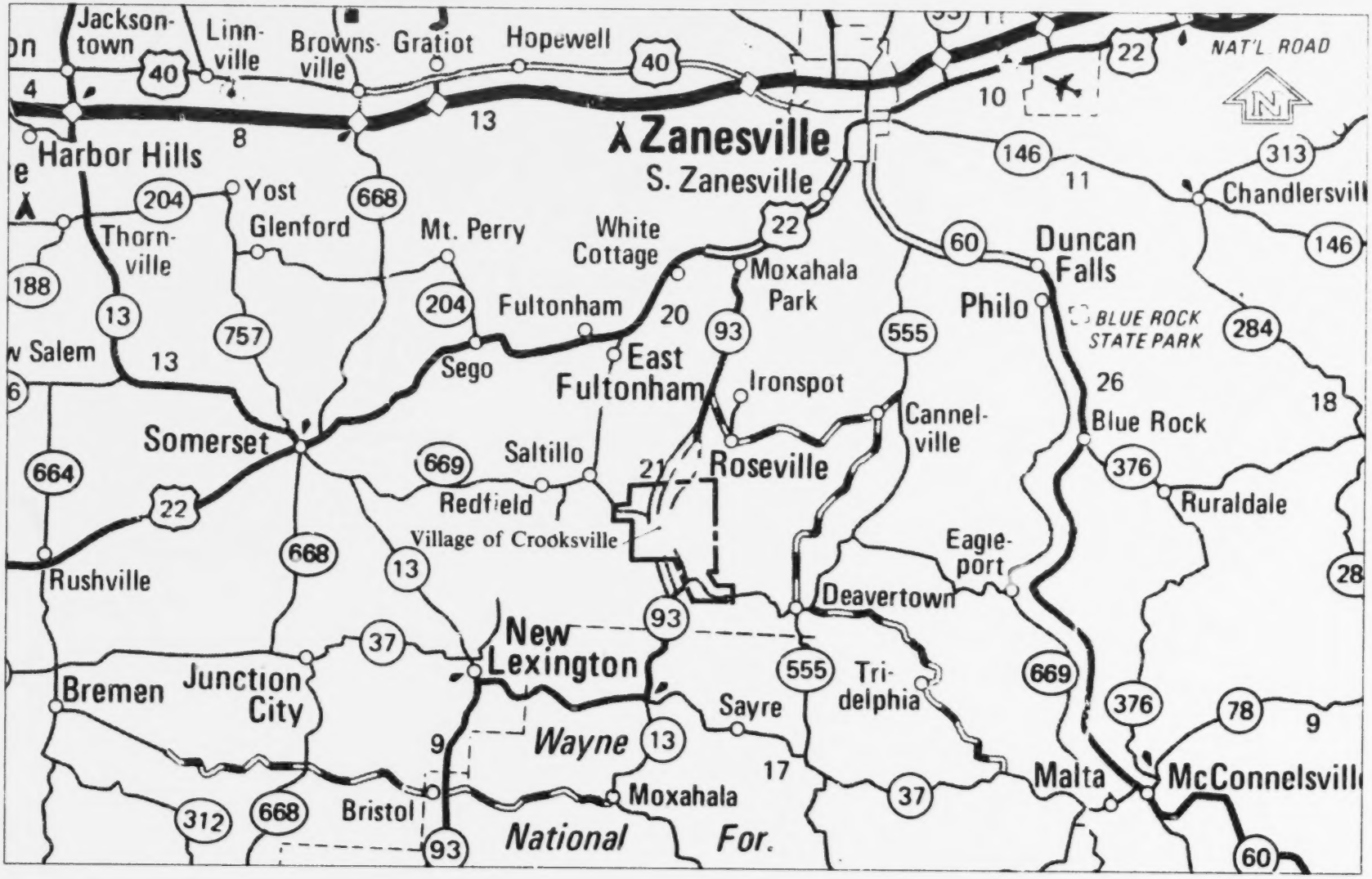

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

APPROXIMATE SCALE
4 0 4 8 12 MILES

VICINITY MAP

report entitled, "The Crooksville Area Flood of June 16-17, 1956," detailed the damage of the flooding. The report stated, "Twenty-five percent of Crooksville was underwater, with depths in the business section reaching as much as 7 or 8 feet. The power substation at Crooksville was drowned out, and later suffered additional damage from an explosion" (Reference 3). Elevations of high-water marks at the power substation's main office (located on Main Street) were provided by the COE, Huntington District. These elevations are 755.99 feet and 750.41 feet National Geodetic Vertical Datum of 1929 (NGVD) for the 1950 and 1963 events, respectively.

No discharge estimates were determined for Moxahala Creek in the vicinity of Crooksville for the 1950 flood. Use of discharge estimates determined downstream of Crooksville and adjusted for drainage-area indicates an approximate recurrence interval in excess of 500 years for the 1950 flood.

2.4 Flood Protection Measures

Flood protection measures are not known to exist within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Flow frequencies for Moxahala Creek at Crooksville were based on a statistical analysis of data from the USGS gage at the Village of Roseville, located approximately four miles downstream. These data were analyzed in accordance with criteria outlined in U.S. Water Resources Council Bulletin No. 17B (Reference 1). Frequency-discharge data were based on a USGS computer model (Reference 5). The model was run using a systematic record of 22 years and a generalized skew coefficient. The State Contractor reviewed the input and assumption of the analysis and used the

this study. The peak discharges determined at the Roseville Gage were then transferred upstream of Crooksville using a drainage-area reduction ratio raised to an exponent. The exponents used with respect to frequency were taken from the Area 2 drainage area-discharge equations in the Ohio Department of Natural Resources Bulletin No. 45 (Reference 6).

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MOXAHALA CREEK					
about 1.74 miles downstream of Main Street	74.9	3,940	5,830	6,740	9,130
just upstream of confluence of Burley Run	69.3	3,750	5,570	6,450	8,750

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data and geometric data for bridges and culverts were obtained from field surveys conducted by Bird and Bull. Limited (Reference 7) and supplemented by field surveys by the Study Contractor.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map.

Channel and overbank roughness coefficients (Manning's "n") used in the hydraulic computations were estimated by field inspection of the Moxahala Creek and floodplain areas. Channel roughness coefficients varied from 0.035 to 0.055 and overbank roughness coefficients varied from 0.045 to 0.100.

Starting water-surface elevations for Moxahala Creek were determined by the slope-conveyance method. USGS step-backwater analysis program J635 (Reference 8) was used to develop water-surface profiles.

Additional hydraulic analyses were performed by the USGS on the Moxahala Creek Overflow Baseline to show more accurate flood elevations.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the NGVD. Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 20 feet (Reference 9) and field observations.

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from

floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and the 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway for Moxahala Creek lie outside the corporate limits.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

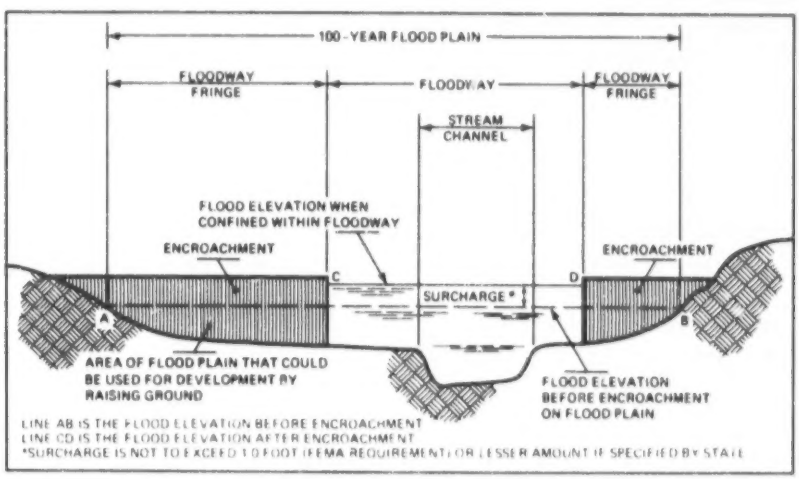
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ FEET)	MEAN VELOCITY (FEET SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MOXAHALA CREEK								
A	1850	640	3085	2.2	746.6	746.6	747.2	0.6
B	3140	300	1880	3.6	747.9	747.9	748.4	0.5
C	3980	560	3216	2.1	749.2	749.2	749.5	0.3
D	4660	560	2788	2.3	749.7	749.7	750.0	0.3
E	5180	180	1275	5.1	750.4	750.4	750.7	0.3
F	5440	90	814	7.9	750.4	750.4	750.7	0.3
G	5610	100	1148	5.6	751.4	751.4	751.7	0.3
H	5950	502	3321	1.9	752.6	752.6	752.9	0.3
I	6160	610	4487	1.4	752.7	752.7	753.1	0.4
J	7020	677	5073	1.3	752.9	752.9	753.2	0.3
K	7250	609	4177	1.6	753.0	753.0	753.3	0.3
L	7480	515	2941	2.2	753.1	753.1	753.4	0.3
M	8850	420	3234	2.0	754.6	754.6	754.8	0.2
N	9080	755	4757	1.4	754.7	754.7	754.9	0.2
O	9800	800	4998	1.3	754.8	754.8	755.1	0.3
P	10,560	775	4101	1.6	754.9	754.9	755.2	0.3

[1] FEET ABOVE LIMIT OF DETAILED STUDY (5500 FEET DOWNSTREAM OF MAIN STREET)

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

FLOODWAY DATA

MOXAHALA CREEK

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The Federal Insurance Administration has published a map of flood-prone areas within the Village of Crooksville (Reference 10).

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the Village of Crooksville, Perry County, Ohio (Reference 11).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.0 REFERENCES AND BIBLIOGRAPHY

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4. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

5. U.S. Department of the Interior, Geological Survey, Open-File Report, 79-1336-1, Annual Flood Frequency Analysis Using U.S. Water Resources Council Guidelines (Program J407), W.D. Lepkin and others, 1979.

6. Ohio Department of Natural Resources, Division of Water, Bulletin No. 45, Floods in Ohio, Magnitude and Frequency, E.E. Webber and W.P. Bartlett, Jr., December 1976.

7. C.F. Bird and R.J. Bull, Limited, Survey for Flood Insurance Study, Village of Crooksville, Ohio, February 1985.

8. U.S. Geological Survey, Open-File Report 76-499, Computer Applications for Step-Backwater and Floodway Analyses, J.O. Shearman, 1976.

9. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 20 feet: Crooksville, Ohio, 1961, photorevised 1975.

10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Map of Flood Prone Areas, Village of Crooksville, Perry County, Ohio, 1981.

11. ---------, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Crooksville, Perry County, Ohio, April 1976.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0001	823.51	standard tablet stamped "9 MJM 1959 824" in first step of walk to residence at 614 N. State Street, 20 feet east of and level with centerline of road
2	0001	749.17	chiseled cross painted blue in northeast corner of north abutment of culvert at Burley Run and Conrail tracks, approximately 30 feet upstream of the confluence of Burley Run and Moxahala Creek
3	0001	748.98	bolt painted blue on northeast corner of northeast sandstone abutment of Conrail bridge over Moxahala Creek downstream of Main Street bridge
4	0001	753.11	chiseled cross painted blue in concrete on northwest corner of northwest wingwall of Main Street bridge over Moxahala Creek
5	0001	750.93	chiseled cross painted blue on corner of northwest sandstone wingwall of Ohio Southern bridge over Moxhala Creek upstream of Main Street bridge
6	0001	750.29	chiseled cross painted blue in northwest corner of northwest stone abutment of railroad bridge over Moxahala Creek approximately 1,350 feet upstream of Industrial Drive bridge over Moxahala Creek
7	0001	756.79	chiseled cross on top of north end of retaining wall between two sets of railroad tracks, approximately 50 feet east of the west tracks, approximately 30 feet south of Industrial Drive

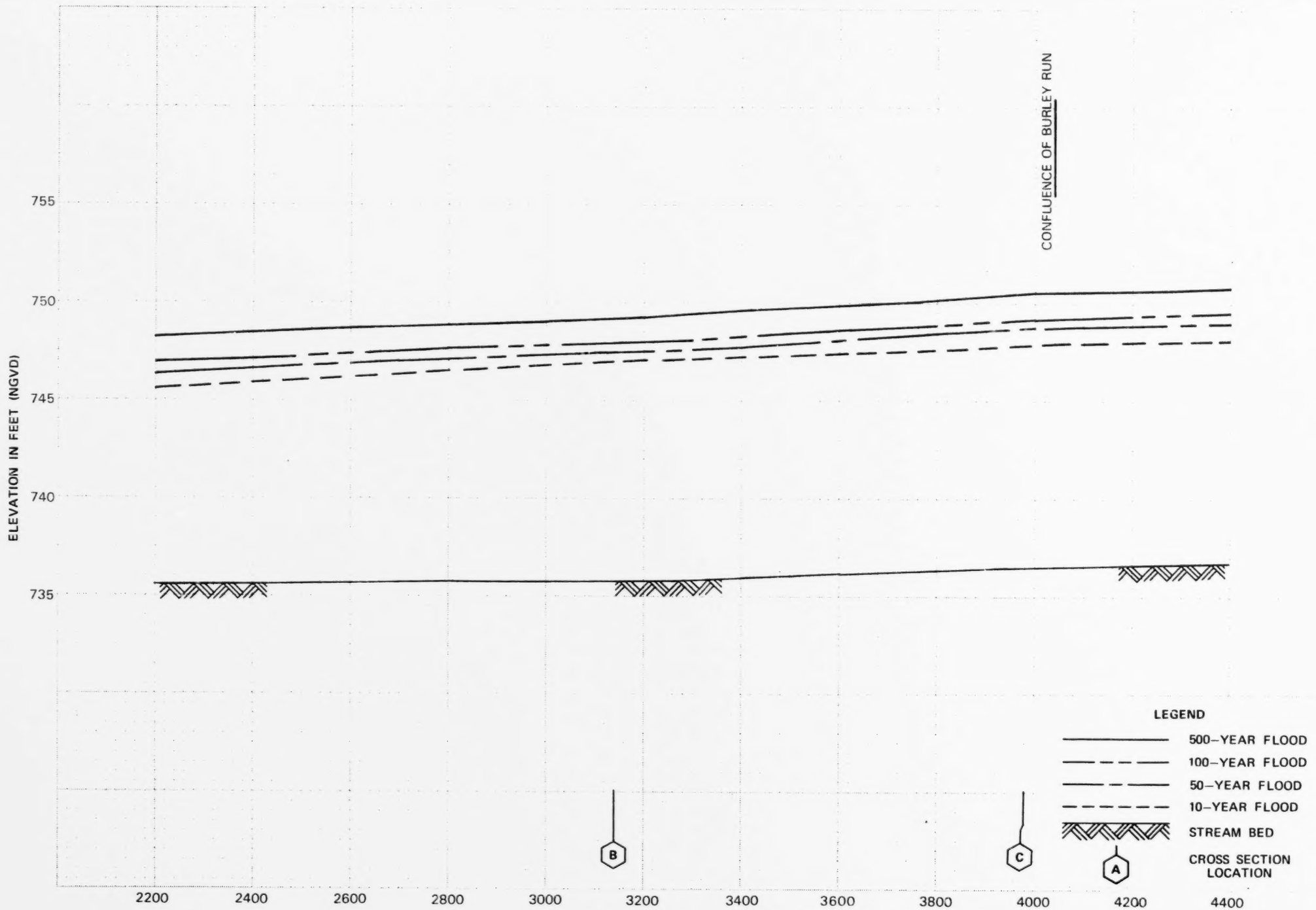
FLOOD PROFILES

MOXAHALA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

01P



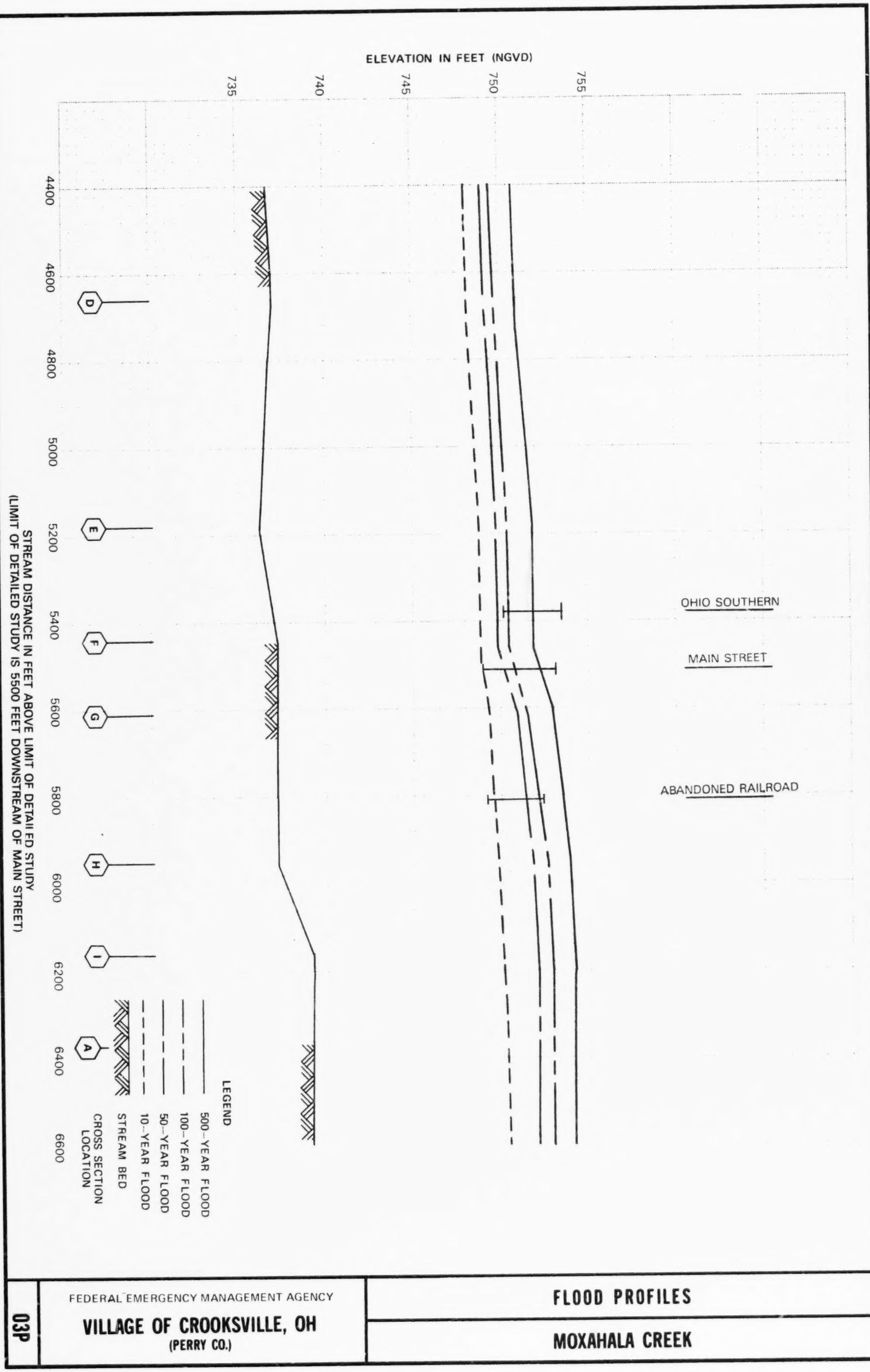
FLOOD PROFILES

MOXAHALA CREEK

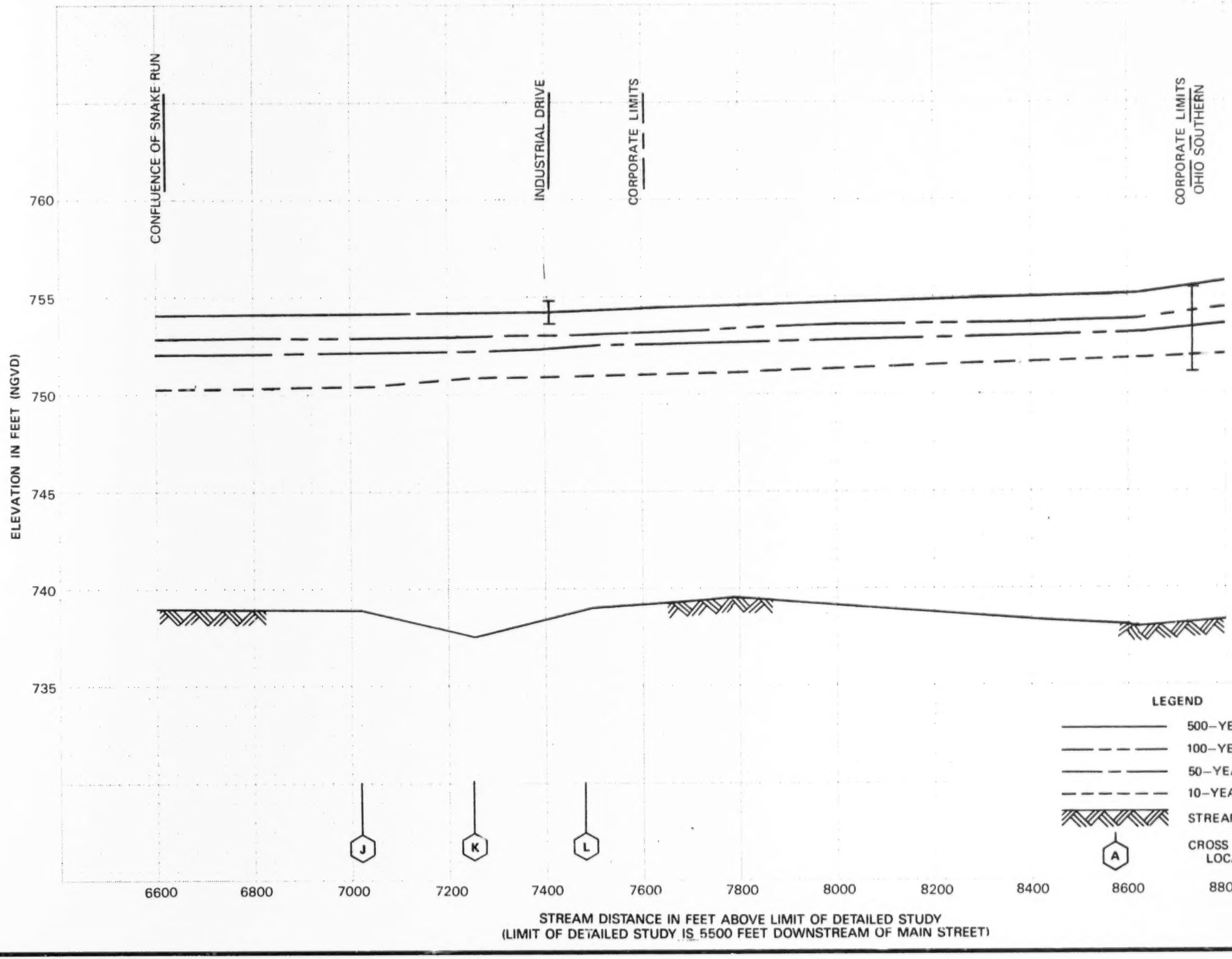
FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

02P



03P	FEDERAL EMERGENCY MANAGEMENT AGENCY **VILLAGE OF CROOKSVILLE, OH** (PERRY CO.)	**FLOOD PROFILES** **MOXAHALA CREEK**



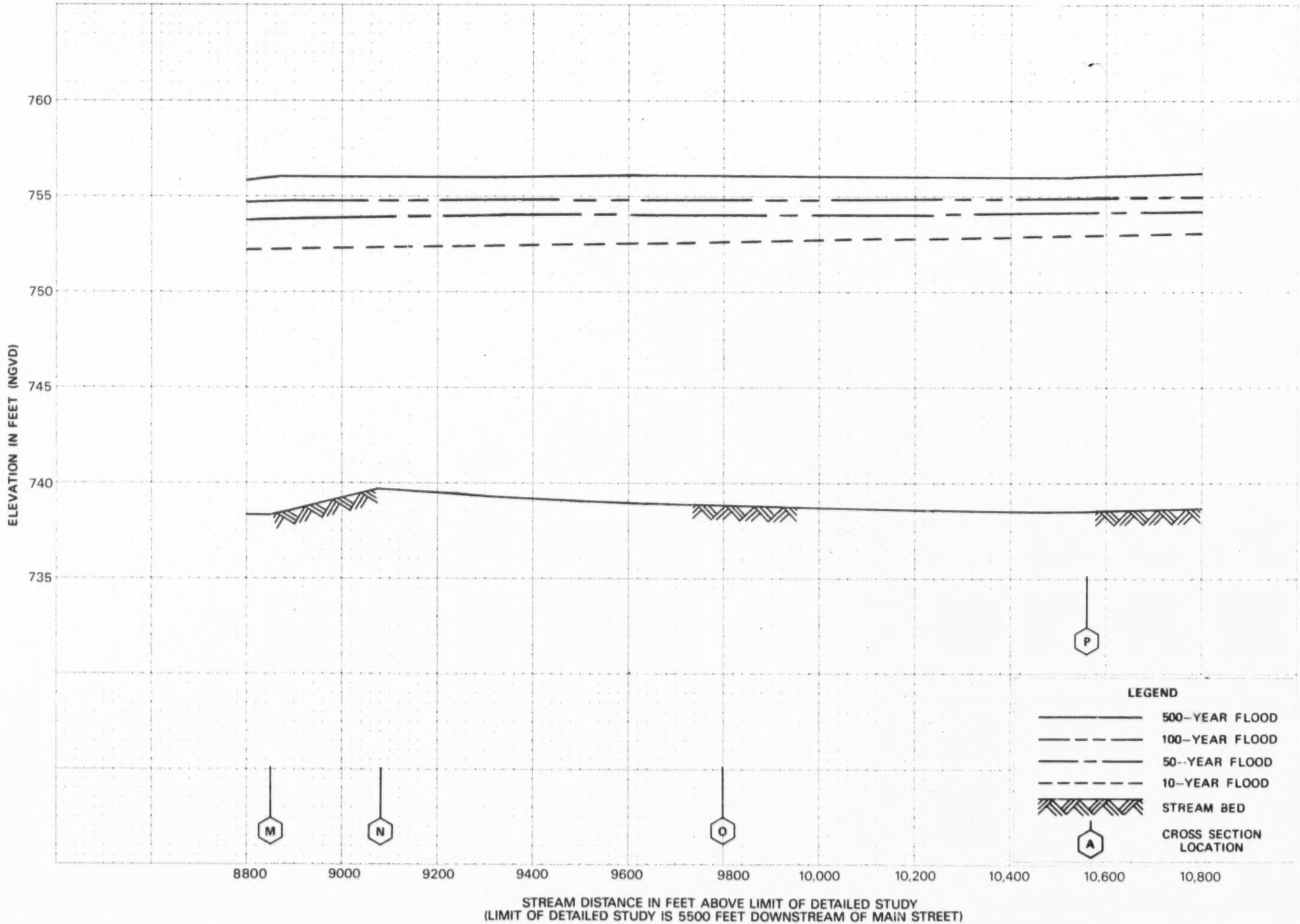
FLOOD PROFILES

MOXAHALA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

04P



FLOOD PROFILES

MOXAHALA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

05P

FLOOD PROFILES

MOXAHALA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

06P

FLOOD PROFILES

MOXAHALA CREEK OVERFLOW BASELINE

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CROOKSVILLE, OH
(PERRY CO.)

07P